

SECTION 16721

ADDRESSABLE FIRE DETECTION & ALARM SYSTEM

PART 1 – GENERAL

1.1 SCOPE

- A. The work includes modifying existing interior fire alarm system devices, that shall be low voltage and modular and be in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.
- B. The control panel is a Simplex Model 4100U addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.
- C. The system shall be in full compliance with applicable National Codes and the 2006 Virginia Uniform Statewide Building Code.
- D. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification, the contract drawings, and applicable local, state, and federal code, whether or not specifically itemized herein.
- E. All additional equipment required shall be new and the latest state of the art products of a system compatible manufacturer engaged in the manufacturing and sale of analog fire detection devices for over five years.
- F. The system as specified shall be supplied, installed, tested, and approved by the local authority having jurisdiction (AHJ), and turned over to the owner in an operational condition.
- G. In the interest of job coordination and responsibilities the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, and final connections.
- H. The locations and types of fire alarm system devices to include alarm initiating appliances, alarm notification appliances, control and trouble signaling equipment, and the location of major components shall not be altered by the Contractor without prior written approval by the Engineer and the Building Official. Changes to the design depicted within the Construction Documents shall be considered substitutions in accord with the General Conditions and are to be documented by Change Order.

1.2 RELATED WORK

- A. Division 1 Bidding Requirements and Conditions Of The Contract.
- B. Division 16 Section 16010 Electrical General Provisions.
- C. Division 13 Section 13930 Wet Pipe Sprinkler Systems with Fire Pump.
- D. Division 15 Energy Monitoring & Control (HVAC).

1.3 STANDARDS & CODES

- A. The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.
- B. Factory Mutual (FM)
 - 1. FM AG Approval Guide.
- C. National Fire Protection Association (NFPA)
 - 1. NFPA 13 – 2007 Standard For The Installation of Sprinkler Systems.
 - 2. NFPA 70 - 2005 National Electrical Code.
 - 3. NFPA 72 - 2007 National Fire Alarm Code.
 - 4. NFPA 90A Standard For The Installation of Air Conditioning And Ventilating Systems.
 - 5. NFPA 101 Life Safety Code.
 - 6. NFPA 170 Standard Fire Safety and Hazmat Symbols
- D. Underwriters' Laboratories, Inc. (UL) Appropriate “UL” equipment standards.
 - 1. “UL” 864 Control Panels.
 - 2. “UL” 268 Smoke Detectors.
 - 3. “UL” 268A Smoke Detectors (HVAC).
 - 4. “UL” 1076 Security.
 - 5. “UL” 1971, Standard for Visual Signaling Appliances.
- E. Building Codes
 - 1. Virginia Uniform Statewide Building Code 2006
 - 2. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction.
 - 3. ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.
 - 4. ADAAG Americans with Disabilities Act Accessibility Guidelines

1.4 QUALIFICATIONS OF INSTALLERS

- A. Before commencing work, submit data showing that the contractor has successfully installed fire alarm systems of the same scope, type and design as specified.
- B. The contractor shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction within the submittals.
- C. The contractor shall employ on staff a minimum of one NICET level II technician and provide proof of such employment within the submittals.

1.5 MANUFACTURER'S REPRESENTATIVE

- A. Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation, maintenance and service of the type of system provided. The representative shall be licensed in the State if required by law. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation, maintenance and programming. Provide copies within the submittals of all applicable certifications of training only from technicians that will actually be assigned and deployed to this project. Engineer may at any time visit site to ensure the technicians on site are the ones that were submitted on.
- B. The contractor shall include the following information in the equipment submittal:
 - 1. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement.
 - 2. Supervisory power requirements for all equipment.
 - 3. Alarm power requirements for all equipment.
 - 4. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.
 - 5. Voltage drop calculations for wiring runs demonstrating worst-case condition.
 - 6. NAC circuit design shall incorporate a 15% spare capacity for future expansion.
 - 7. Complete manufacturers catalog data including supervisory power usage, alarm power usage, physical dimensions, finish, and mounting requirements.
 - 8. Complete drawings covering the following shall be submitted by the contractor for the proposed system:
 - a) Floor plans in a CAD compatible format showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used. Wiring for the fire alarm system is not shown on the contract drawings. The contractor shall lay out the wiring arrangement between the system

components in the most convenient form for their installation and show it on the floor plans. At the conclusion of the project, the contractor shall correct and modify this wiring layout to conform with the actual runs and connections for inclusion into the final set of record drawings.

- b) A complete fire alarm job specific riser diagram showing all addressable, notification, communication, shutdown, and power circuits and their relative service areas in the building that are attached to the fire alarm system. Include all candela ratings, device addresses, and room numbers.
- c) Typical job specific wiring diagrams for all field devices used in the proposed system. Diagrams shall be sized and laid out so that individual wire detail can be determined.
- d) A job specific wiring diagram of the fire alarm control panel and all associated control panels (i.e. transponders, NAC extender panels, communicators, remote annunciators, etc.)
- e) Provide a fire alarm system function matrix as referenced by NFPA 72, Figure A-7-5.2.2 (9). Matrix shall illustrate alarm input/output events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.

9. Incomplete submittals may be returned without review.

1.6 SYSTEM REQUIREMENTS

- A. The system shall be a complete, electrically supervised fire detection and notification system, microprocessor based operating system having the following; capabilities, features and capacities:
 - 1. Communication between network nodes, each supporting an interactive, self-standing, intelligent local control panel, with system wide displays.
 - 2. The local system shall provide status indicators and control switches for all of the following functions:
 - a) Audible and visual notification alarm circuit zone control.
 - b) Status indicators for sprinkling system water-flow and valve supervisory devices.
 - c) Any additional status or control functions as indicated on the drawings, including but not limited to; emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.
 - 3. Each intelligent addressable device or conventional zone on the system shall be displayed at the main fire alarm control panel and any local fire alarm control panel by a unique alphanumeric label identifying its location.

4. All control panels and transponders within the system that require a 120 VAC connection shall be provided with an AC hard-wired transient voltage surge suppressor that conforms to UL and IEEE C62.41B and have the following characteristics.

Connection Method: Hardwire parallel connection

Continuous Current: Unlimited (Parallel Installation)

<5nSec Installed, <1nSec Component

Response Time: Level

MCOV: 130 VRMS/185 VPK

Operating Frequency: 50/60Hz

AC Protection Modes: L - N, L - G, N - G

Service Voltage: 110 / 125 VAC

Diagnostics: Indicator Light

EMI/RFI Noise Filtering: Yes

Max Surge Current: 22,500 Amps

Max Energy Dissipation: 190 Joules

Surpressed Voltage Rating: 600V

Operating Temperature

Range: -40 degrees C. to +85 degrees C.

Be certain that all units are grounded properly and connected to a good source of building ground.

1.7 SYSTEM OPERATION

- A. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications at all alphanumeric displays in the system.
- B. Fire Alarm Condition:
 1. Sound an audible alarm and display a custom screen/message defining the building in alarm and the specific alarm point initiating the alarm.
 2. Log to the system history archives all activity pertaining to the alarm condition.
 3. Sound the ANSI 117-1 signal with synchronized audibles and synchronized strobes throughout the facility.
 4. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.
 5. A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.
 6. The alarm information shall be displayed on an existing system display annunciator located where shown on drawings.
 7. HVAC shut down shall be accomplished by system operated duct detectors as per local requirements.

C. Supervisory Condition:

1. The supervisory information shall be displayed on an existing system display annunciator located where shown on drawings.
2. Activate supervisory audible and dedicated visual signal.
3. Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.
4. Record within system history the initiating device and time of occurrence of the event.

D. Trouble Condition:

1. The trouble information shall be displayed on an existing system display annunciator located where shown on drawings.
2. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.
3. Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.
4. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

PART 2 – PRODUCT

2.1 CONTROL PANEL

- A. The fire alarm control panel is an existing Simplex Model 4100U.
- B. Control panel shall be listed under UL classification UOJZ as a proprietary protected premises control unit for A, M, WF, and SS service.

2.2 POWER SUPPLY, BATTERY, & BATTERY CHARGER - EXISTING

2.3 SYSTEM ENCLOSURES - EXISTING

2.4 REMOTE ANNUNCIATORS - EXISTING

2.5 DIGITAL ALARM COMMUNICATION TRANSMITTER (DACT) - EXISTING

2.6 INTELLIGENT INITIATION DEVICES

- A. The smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and duct sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. The intelligent smoke detector shall be capable of providing three distinct

outputs from the control panel. The system controlled output functions shall be from an individual or unique input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber. The detector shall support the use of a relay and LED remote indicator at the same time.

- B. Thermal Detectors shall be rated at 135 degrees fixed temperature and 15 degrees per minute rate of rise. Detectors shall be constructed to compensate for the thermal lag inherent in conventional type detectors due to the thermal mass, and alarm at the set point of 135 degrees Fahrenheit. The choice of alarm reporting as a fixed temperature detector or a combination of fixed and rate of rise shall be made in system software and be changeable at any time without the necessity of hardware replacement. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet and shall be installed according to the requirements of NFPA 72 for open area coverage.
- C. The duct smoke detector shall be an intelligent digital photoelectric detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. The detector shall be mounted in a duct detector housing listed for that purpose. The duct detector shall support the use of a remote test switch, relay or LED remote indicator. Provide remote indicator lamps or LED's in clearly visible locations for duct detector units that are hidden from view while standing on the floor. Detectors shall also be provided with enough auxiliary relay contacts to interface to any peripheral equipment as shown on contract drawings. Relays shall be capable of activating either by following the state of the associated detector or be globally controllable from any point in the system. The duct detector shall be supplied with sampling tubes that are specifically sized to the width of the duct at the location where the unit is to be installed. In no case should a larger sampling tube that is meant for larger ducts be cut down to accommodate a smaller duct where a smaller standard size tube is available. Where duct detectors are exposed to the weather provide a weatherproof enclosure. Duct detector units shall be provided and connected under this division and mounted by the Division 13 contractor.
- D. Detector bases shall be low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on an industry standard, 4" square or octagonal electrical outlet box.
 - 1. Where selective localized control of electrical devices is required for system operation, furnish and install detector base with software programmed addressable relay integral to the base. The relay shall switch electrical loads within relay ratings, as indicated on the drawings. Operation of the addressable control circuit shall be independent of the number of detectors and relays on the circuit or the number in an alarm state. Relay bases shall be rated for resistive or inductive load (120VAC or 30VDC) 3 amps.
 - 2. Where indicated on the drawings, furnish detector base with integral approved audible evacuation alarm signal having an output of 85db. The audible signal shall be individually addressable and software programmed for operation.
- E. Provide double action addressable manual stations where shown on the drawings, to be flush or surface mounted as required. Manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel. The manual

station communications shall allow the station to provide alarm input to the system and alarm output from the system within less than four (4) seconds. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer's prescribed matching red enamel outlet box.

- F. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches that are required to be connected to the fire alarm system. Provide the connection to these devices whether they are shown on the electrical contract drawings or not. These interface devices shall have single or dual contact monitoring capabilities. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive.

2.7 NOTIFICATION APPLIANCES

- A. The horn or horn/strobe appliance as indicated on the drawings shall be a synchronized temporal horn with a synchronized strobe light with multiple candela taps to meet the intended application. The strobe light taps shall be adjustable for 15, 30, 75, and 110 candela. The strobe shall flash at a rate between 1/3 and 3 flashes/second. The sound output shall be rated at a minimum of 95 dBA at 10 ft. when tested in an anechoic chamber. The appliance shall be red for wall mounted and white for ceiling mounted. Ceiling mounted appliances shall be rated for that application.
- B. The strobe only appliance as indicated on the drawings shall be a synchronized strobe light with multiple candela taps to meet the intended application. The strobe light taps shall be adjustable for 15, 30, 75, and 110 candela. The appliance shall be red for wall mounting and white for ceiling mounted. Ceiling mounted appliances shall be rated for that application.
- C. An alarm extender panel shall be provided where needed. The power supply shall be a minimum of 6 amps. The power supply shall contain four supervised notification circuits maximum of 3 amps each circuit. The power supply shall contain built-in synchronizing modules for strobes and audibles. There shall be a 3 amp filtered auxiliary power limited output. There shall be a minimum of 8 options as to the operations of the inputs and outputs.
- D. Sprinkler System Bell - On projects that require sprinkler system monitoring, provide a weatherproof bell mounted where shown on the contract drawings. Bell shall operate on panel notification circuit and alarm only when a sprinkler related alarm occurs. Provide with weatherproof backbox that matches the color of device. Provide device with standard 4" square mounting, 4" min bell, vibrating operation with minimum 75dB UL rating.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Perform work in accordance with the requirements of NFPA 70 and NFPA 72.
- B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.
- C. All fire alarm cabling shall be supplied in conduit.

3.2 BOXES, ENCLOSURES AND WIRING DEVICES

- A. Boxes shall be installed plumb and firmly in position.
- B. Extension rings with blank covers shall be installed on junction boxes where required.
- C. Junction boxes served by concealed conduit shall be flush mounted.
- D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

3.3 CONDUCTORS

- A. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
- B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.
- C. Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits shall be minimum 18 AWG.
- D. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer recommendations.
- E. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
- F. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.
- G. A consistent color code for fire alarm system conductors shall be used throughout the installation.
- H. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.4 DEVICES

- A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.
- B. Wiring within sub-panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.
- C. All devices and appliances shall be mounted to or in an approved electrical box.

3.5 FIELD QUALITY CONTROL

A. Testing, general

1. All Alarm Initiating Devices shall be observed and logged for correct zone and sensitivity. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the initials of the installing technician and date.
2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
3. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
4. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
5. Test reports shall be delivered to the acceptance inspector as completed.
6. The installing contractor shall make instruments, tools and labor required to conduct the system tests available.
7. The following equipment shall be a minimum for conducting the tests:
 - a) Ladders and scaffolds as required to access all installed equipment.
 - b) Multimeter for reading voltage, current and resistance.
 - c) Two way radios, and flashlights.
 - d) A manufacturer recommended device for measuring airflow through air duct smoke detector sampling assemblies.
 - e) Decibel meter.

- B. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the Engineer of Record and the AHJ.

3.6 ACCEPTANCE TESTING

- A. The contractor shall be responsible for demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.
- B. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.
- C. The installing contractor, prior to the final test shall prepare a complete listing of all device labels for alphanumeric annunciator displays.

- D. The Contractor shall be responsible for contacting the Regional Office of the State Fire Marshal to coordinate their witness of the below tests (at a minimum).
- E. The acceptance inspector shall use the system record drawings in combination with the documents specified during the testing procedure to verify operation as programmed. In conducting the acceptance test, the inspector may request demonstration of any or all input and output functions.
- F. The items tested shall include but not be limited to the following:
 - 1. System wiring shall be tested to show the following results and the system subsequence operation:
 - a) Open, Shorted or Grounded Circuits.
 - b) Primary and Battery power disconnected.
 - 2. System notification circuits and appliances operate as programmed. Audibility and Visual levels meet required standards.
 - 3. System shall demonstrate the correct messages at the FACP and Remote Annunciator.
 - 4. System off site reporting shall be verified for alarm, supervisory and trouble.
 - 5. System shall be tested for stand-by battery back up as outlined in this specification.

3.7 DOCUMENTATION

- A. System documentation shall be supplied to the owner and shall include but not be limited to the following:
 - 1. System record drawings and wiring details (4 copies) including one set of reproducible drawings, and a CD ROM with copies of the record drawings in DXF format for use in a CAD drafting program.
 - 2. System Operating, Installation and Maintenance Manuals (4 copies).
 - 3. System matrix showing input signals to output commands.
 - 4. Provide a copy of the system program on a CD/DVD.
 - 5. **Warranty letter that details what is covered under the warranty and the start and end dates.**
 - 6. **NFPA 72 record of completion form filed out in its entirety by the fire alarm contractor.**

3.8 WARRANTY AND SERVICES

- A. The contractor shall warranty the entire system for electrical and mechanical failures for a period of one year. This warranty shall include all parts, labor, maintenance, and

software upgrades. The warranty shall begin with the completion of the acceptance testing or when beneficial use to the owner is determined.

- B. The fire alarm system subcontractor or manufacturer shall offer for the owner's consideration at the time of system submittal a priced inspection, maintenance, testing, and repair contract in full compliance with the requirements of NFPA 72, broken out annually for a period of 3 years after the initial warranty period has expired. If applicable, include any and all optional levels of support ranging from minimum (i.e. time and materials) to complete turnkey coverage (i.e. 4 hour response time). Submittals that do not include this offering shall be considered incomplete and be returned without review.
- C. Any future system additions shall include a separate breakdown of both parts and labor. Labor breakdown must include anticipated number of technician hours necessary to complete the addition. Future submittals or cost proposals that do not include this information shall be considered incomplete and be returned without review.
- D. The contractor performing the contract services shall be qualified, factory trained, and certified in the service and maintenance of the system provided and listed to maintain ongoing certification of the completed system to the "UL" installed system listing.
- E. The installation contractor shall furnish training as follows:
 - 1. Training in the receipt, handling, and acknowledgment of alarms.
 - 2. Training in the system operation including manual control of output functions from the system control panel.
 - 3. The total training requirement shall be a minimum of 2 hours, but shall be sufficient to cover all items specified. The contractor shall provide two such training sessions.

END OF ADDRESSABLE FIRE DETECTION & ALARM SYSTEM